Electronics Manufacturing

Proposed Rule: Mandatory Reporting of Greenhouse Gases

United States Environmental Protection Agency

Under the proposed Mandatory Reporting of Greenhouse Gases (GHGs) rule, owners or operators of facilities that contain electronics manufacturing (as defined below) would report emissions from all electronics manufacturing processes and all other source categories located at the facility for which methods are defined in the rule. Owners or operators would collect emission data; calculate GHG emissions; and follow the specified procedures for quality assurance, missing data, recordkeeping, and reporting.

How Is This Source Category Defined?

Under the proposal, the electronics manufacturing category consists of:

- Semiconductor facilities with an annual production capacity exceeding 1,080 square meters (m^2) of silicon.
- Liquid crystal display (LCD) facilities with an annual capacity exceeding 235,700 m^2 of LCD.
- Microelectromechanical system (MEM) facilities with an annual production capacity exceeding 1,020 m^2 of silicon.
- Photovoltaic (PV) cell facilities that emit 25,000 metric tons of carbon dioxide equivalent (CO_2e) per year from stationary combustion and other source categories (e.g., fluorinated GHG emissions from CVD clean processes).

What GHGs Would Be Reported?

The proposal calls for electronics manufacturing facilities to report:

- Fluorinated GHG (F-GHG) emissions from all plasma etching processes combined.
- F-GHG emissions from all chamber cleaning processes combined.
- Nitrous oxide (N_2O) emissions from chemical vapor deposition (CVD).
- F-GHG emissions from processes using fluorinated compounds as heat transfer fluids.

In addition, each facility would report GHG emissions for other source categories for which calculation methods are provided in the rule. For example, facilities would report carbon dioxide (CO_2), N_2O, and methane (CH_4) emissions from each stationary combustion unit on site by following the requirements of 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources). Please refer to the relevant information sheet for a summary of the proposal for calculating and reporting emissions from any other source categories at the facility.

How Would GHG Emissions Be Calculated?

Under the proposal, owners or operators of facilities that manufacture electronics would calculate GHG emissions as follows:

- For both the plasma etching and chamber cleaning process, the emissions of each F-GHG emitted would be calculated as the sum of the emissions from the input gas and byproduct gas.

  For input gas, emissions would be calculated using:

  - The amount of F-GHG input to the process (required to be measured).
  - The process utilization rate for the F-GHG.[1]

[1] Semiconductor facilities with an annual capacity greater than 10,500 m^2 of silicon would be required to use process-specific utilization and byproduct formation factors developed in accordance with the International

  - The fraction of F-GHG used in process units equipped with an abatement device (required to be measured).
  - The fraction of F-GHG destroyed by the abatement device.[2]

For byproduct gas, emissions would be calculated using:

  - The amount of F-GHG input to the process (required to be measured).
  - The kilograms (kg) of F-GHG generated as a byproduct per kg of input gas.[1]
  - The amount of F-GHG used in process units equipped with an abatement device (required to be measured).
  - The fraction of F-GHG destroyed by the abatement device, if the facility wishes to reflect the emission reductions due to these devices in its emission estimates. (Facilities wishing to reflect these reductions would be required to verify the destruction or removal efficiency (DRE) of the abatement devices.)[2]

- For N_2O emissions from chemical vapor deposition, the annual emissions would equal the amount of N_2O consumed.
- For F-GHG emissions from heat transfer fluids, the annual emissions of each F-GHG would be calculated using a mass-balance approach that accounts for the following operational parameters:
  - Decrease in the amount F-GHG stored on site
  - Amount purchased
  - Amount sent off site
  - Nameplate capacity of any new units
  - Nameplate capacity of any retired units

What Information Would Be Reported?

In addition to the information required by the General Provisions at 40 CFR 98.3(c), the proposal calls for each annual report to include the following information:

- Annual emissions of each F-GHG emitted from all plasma etching.
- Annual emissions of each F-GHG emitted from all CVD chamber cleaning.
- Annual emissions of each F-GHG used as a heat transfer fluid.
- Annual emissions of N_2O from all CVD units.
- The method, F-GHG input, and F-GHG utilization and byproduct formation factors used to calculate F-GHG emissions.
- Annual production in terms of substrate surface area (e.g., silicon, LCD).
- The fraction of each F-GHG input to processes equipped with an abatement device.
- The removal and destruction efficiency for each abatement device.
- A description of all abatement devices, including the number of devices of each manufacturer and model.
- All data used to calculate F-GHG emissions from the use of heat transfer fluids.
- Example calculations for F-GHG from plasma etching and chamber cleaning.
- Example calculations for F-GHG from use of heat transfer fluids.
- An estimate of the overall uncertainty in the GHG emission estimate.

For More Information

This series of information sheets is intended to assist reporting facilities/owners in understanding key provisions of the proposed rule. However, these information sheets are not intended to be a substitution for the rule. Visit EPA's Web site (www.epa.gov/climatechange/emissions/ghgrulemaking.html) for more information, including the proposed preamble and rule and additional information sheets on specific industries, or go to

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SEMATECH Manufacturing Initiative's Guideline for Environmental Characterization of Semiconductor Process Equipment. All other facilities would use the default factors provided in the rule.

[2] Facilities would have the option of either testing the control device themselves or using third-party test data (e.g., manufacturer's test data).

This document was developed for the *Proposed* Mandatory GHG Reporting Rule. For the final document, please visit the *final* Mandatory Reporting of Greenhouse Gases Rule.

<www.regulations.gov> to access the rulemaking docket (EPA-HQ OAR-2008-0508). For questions that cannot be answered through the Web site or docket, call 1-877-GHG-1188.